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Poisonous plants of the world

Edition 3

Harold N. Moldenke

Inasmuch as I am not a medical man, the material in this paper must be regarded as strictly slanted from a taxonomic botanist's viewpoint. It has been prepared, as were the previous edition, for presentation to the class of graduate students in the School of Medicine of New York University. A bibliography of poisonous plants prepared by Harriette S. Kellogg and published in 1911 contains 1097 entries, Bringing this bibliography up-to-date would easily extend the number of titles on this subject to 3000. Some of the works found most useful by me are listed at the close of this paper. L. H. Pammel, in his classic "A manual of poisonous plants" (1911), lists about 2900 species. Dr. A. Bernhard-Smith, in his "Poisonous plants of all countries", edition 2 (1923), boils these fown to about 400 species known to be poisonous and 296 more that are "reputed poisonous". Of those known to be poisonous he lists 152 as the most important. Noah Webster's "Imperial dictionary of the English language" (1910-1911) illustrates in color 16 species, presumably those regarded as the most important. In the list covering the following pages I have selected some 500 species which seem most important to me. This list includes all of the 400 enumerated by Bernhard-Smith, plus others taken from Pammel and from other sources. The ones illustrated by Webster are indicated by the letter "W". Those from which fatalities have been recorded are marked by the letter "F". The general classification is that of Bernhard-Smith.

It must be remembered that some persons may prove to be allergic to almost any specific plant. Plants whose reaction is purely allergic are not included here for obvious reasons. The many injurious bacteria and micro-fungi are also not included in this list, and higher fungi ("toadstools") are included only incidentally. Although some of the most deadly members of the plant kingdom are to be found in these groups, a classification and discussion of them must be left to an expert in cryptogamic botany.

Dr. Theodore R. Van Dellen in a recent newspaper article states that "More than 50 plants in the United States are dangerous to handle, squeeze, or swallow. Many are no farther away than our gardens; others are in the fields, woods and surrounding countryside. It is a problem to become acquainted with rather than to fear because for every poisonous plant there are dozens of innocuous ones."

The poisonous principles of most of the plants here described are known to exist even when the plants are under cultivation, although cultivation may greatly modify their virulence. Some of our most popular vegetables and fruits are poisonous in the wild state. Among these are the lima bean, potato, tomato, celery, carrot, parsnip, tapioca, and rhubarb. Exposure, also, to the influence of heat, acids, or antiseptics seems in many cases to render the toxin inert. Many taxonomic species apparently consist of several or many physiologic races which differ slightly or markedly in the amount of toxin which they produce. A famous example of this is the case of the lima bean and Java bean -- although taxonomically indistinguishable, the one is quite edible and the other extremely poisonous. A similar case is seen in the case of the stubbleberry and the black nightshade -- the former edible and the latter very poisonous, and yet many botanists regard both as the same species.

Differences in soil and climatic conditions also effect the virulence of some species. A noteworthy example is the hemp plant, which under some growing conditions will produce the toxic marijuana principle, while under others will not.

A very large proportion of the conflicting results as to toxicity obtained by medical, chemical, and pharmacological experimenters, however, can be traced to mere mis-identification of source materials. Unless material of botanical nature is first submitted to qualified botanical taxonomists for identification or verification, the chances in many cases are quite large that it will be incorrectly named. Research of chemical or pharmacologic nature performed with such mis-identified botanical material will naturally lead to confusing or even conflicting results. Good examples of this situation are furnished in the case of curare-yielding plants and cortisone-yielding plants. Before careful taxonomic research was performed on

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the genera to which these plants belonged, the exact sources of the drugs were in considerable doubt and confusion, leading to continuously conflicting results. Only after the groups were thoroughly monographed by botanical taxonomists and the true sources of the various types and concentrations of the drug determined, could pharmacologic and medical progress be made. This is another example of the truism, so often overlooked or forgotten by unthinking persons, that the systematic botanist works in the most important and fundamental of all the botanical sciences.

In the treatment of poisoning by the higher or phanerogamous plants the generally recommended remedies include, according to Bernhard-Smith (page viii), the following:

1. Diluents -- wash out the stomach with plenty of warm water.
2. Emetics -- especially mustard.
3. Purgatives -- such as castor oil.
4. Demulcents -- such as sweet oil or raw eggs.
5. Rest and warmth.
6. Antidotes:
    - Tannin -- strong coffee or tea
    - Iodine -- dilute solution. For opium poisoning.
    - Digitalis -- tinct. B.P.♏xx. hypoderm. For aconite poisoning.
    - Pilocarpine -- nit. gr. 1/3. hypoderm. For deliriant poisoning.
7. Stimulants [for depressant poisoning]:
    - Strong ammonia to the nostrils [alcohol was formerly recommended, but this is now generally regarded as itself a depressant].
    - Strychnine -- sol. B.P.♏ii. hypoderm.
    - Atropine -- gr. 1/2. hypoderm.
    - Faradic current.
    - Oxygen inhalation.
    - Artificial respiration.
8. Sedatives:
    - Opium -- for purgative or irritant poisoning.
    - Chloroform inhalation -- for convulsive or irritant poisoning.
    - Chloral -- for convulsive or irritant poisoning.
    - Potassium bromide -- for convulsive or irritant poisoning.

The following is an alphabetic list of the most important poisonous principles contained in plants listed on the following pages, as taken from Bernhard-Smith (pages xi and xii). They are classified in 7 categories or groups.

A. Vegeto-alkaloids. These are compound ammonias -- nitrogenous bitter principles which act as bases, are sparingly soluble in water, and combine with acids to form salts.

aconitine
adamstonine
agaricine
akargine
alstonine
arecoline
arictine
artarine
atropine
berberine
brucine
buphanine
buxidine
buxine
calabarine
calamine
carpaine
cevadine
coniceine
consolidine
coroniline
curarine*
cusperine
cynapine
cynoglossine
cytisine
delphinine
delphinoidine
delphinisine
dioscorine
drumine
emetine
ergotoxine
erythrine
erythrophloine
eserine
hyoscyamine
hyoscine
imperialine
incine
jervine
laurotetanine
lobeline*
loliine
lophorine
loturidine
mandragorine
mercurialine
mescaline
morphine
muawine
muscarine*
nandanine
narcissine
pithecolobine
porphyrine
pseudoaconitine
pukateine
rhoeadine
ricinone
sanguinarine
sapotoxine
scrophularine
senechifoline
solanine
sparteine*
spigeline
stillingine
strychnine
taxine
temuline
thebaine

- chelidonine
- chelerythrine
- chloroxylonine
- choline
- cicutine
- clematine
- cocaine
- codeine
- colchicine
- conine*
- fumarine
- gelseminine
- glaucine
- gleditschine
- grandiflorine
- guipsine
- gymnocladine
- harmaline
- heliotropine
- hydrastine
- nicotine*
- oleandrine
- pellitarine
- pellotine
- phalline
- phytolaccine
- piliganine
- pilocarpine
- piperovatine
- piscidine
- timbonine
- trigonelline
- veratrine
- veratrone
- xanthoxyline

* Liquid and volatile

B. Glucosides. These are carbohydrates which are usually crystalline; when decomposed by acids or by chemical ferments (enzymes) they split up into glucose and an alcohol, aldehyde, phenol, or other product.

- acorin
- adonidin
- aesculin
- amygdalin
- andromedotoxin
- anemonin
- antiarin
- arbutin
- arnicin
- artemisin
- asarin
- asclepiadin
- bryonin
- cerberin
- chiancin
- chrysarobin
- convallamarin
- convallarin
- coriamyrtin
- crocin
- cuscutin
- cyclamin
- digitalin
- digitoxin
- erecolin
- frangulin
- gitalin
- githagin
- hederin
- heleborin
- inulin
- iridin
- jalapin
- kurakin
- ligustrin
- ligustron
- linarin
- mallotoxin
- megarrhizin
- oubain
- paristyphnin
- phaseolunetin
- polygalin
- rhinanthin
- ricin
- rosaginin
- santonin
- saporubin
- smilacin
- stropantin
- tanghinin
- tutin
- xanthostrumarin
- xyloglostein

C. Organic acids. These are hydrocarbons requiring a vital power to effect their formation.

- absinthic
- angelic
- chrysophanic
- crotonoleic
- equisetic
- euodic
- filicic
- formic
- helvellic
- prussic
- rheonilic
- sphacelinic

D. Neutral principles. These are proximate crystalline bodies whose chemical characters have not yet been determined.

- aloin
- andirin
- apocynamarin
- apocynin
- aristoloctin
- a-toxic
- boldin
- colocynthin
- convolvulin
- coumarin
- echujin
- elaterin
- euphorbin
- hyaenanchin
- lactucin
- lininarin
- lupinotoxin
- megarrhizatin
- menianthin
- monesin
- myristicin
- narthecin
- nereodorein
- nereodorin
- periplocin
- phylanthin
- plumbagin
- podophyllotoxin
- robin
- scillipiain
- scillitoxin
- syringin
- thevetin
- thevetoxin
- urechitoxin
- vellarin
- viburnin

E. Resins. These are complex hydrocarbons which are formed among the oxidation-products of the volatile oils.

- cambogin or gambogin
- euonymin
- gratiolin
- guiacum
- mezerein
- oenanthin

F. Volatile oils. These are aromatic non-greasy hydrocarbons which impart their properties to water and contain alcohols, ketones, stearoptines, etc.

- anemone
- baneberry
- bay
- borneol
- cannabinol
- cardol
- cedar
- cicuta
- crotonal
- euphorbia
- houndstongue
- jequiritol
- pennyroyal
- plumbago
- rue
- savin
- tansy
- toxicodendrol
- valerian
- wintergreen
- yew

G. Acrid juices and milks. Not yet identified.

A classification of poisonous plants according to their effects

I. Those acting on the brain
  1. Narcotics (3)
  2. Deliriants (39)
  3. Inebriants (6)
II. Those acting on the spinal cord
  4. Convulsives (11)
III. Those acting on the heart
  5. Depressants (30)
  6. Asthenics (96)
IV. Irritant poisons
  7. Purgatives (34)
  8. Irritants with nerve-symptoms (66)
  9. Simple irritants (245)

Total classified = 530

- - - - - - - - - - - -

I. Those acting on the brain.

1. Narcotics. Symptoms: giddiness; dimness of sight; contracted pupils; headache; noises in the ears; confusion of ideas; drowsiness, passing into insensibility. Plant families: Papaveraceae, Poaceae.

Papaver somniferum (opium poppy, white poppy, carnation poppy, peony poppy, joan-silverpin, balewort, garden poppy). Native from Greece through the Balkans to Turkey, Syria, and parts of Asia; widely naturalized in Europe; extensively cultivated in China, India, Syria, and elsewhere; cultivated as a garden flower in the United States, and occasionally found spontaneous around old gardens. From the milky exudation that comes after making an incision in the unripe capsule opium is obtained which yields from 5 to 22 percent of crystallized morphine. The chief toxic principles are morphine, codeine, and thebaine. Fourteen other alkaloids are included, however -- hydrocotarnine, pseudomorphine, protopine, laudanine, codamine, papaverine, meconidine, cryptopine, laudanosine, narcotine, lanthopine, and gnoscopine. Opium is said to be "the most valuable and important medicine of the whole materia medica and the source, by its judicious employment, of more happiness, and, by its abuse, of more misery than any other drug employed by mankind." There are occasional cases of poisoning from the plant, but most of the recorded cases are due to overdoses of opium. W F

Papaver rhoeas (corn poppy, cornflower, cornrose, canker-rose, cock-rose, cop-rose, copper-rose, blind-eyes, headache, redweed, field poppy, red poppy, african-rose, cheesebowl, thunderflower, blue-eyes). Native of Europe; widely cultivated; escaped in northeastern North America, Bermuda, and Vancouver Island. The toxic principles are rhoeadine and perhaps also morphine. As it grows in fields it effects mostly farm animals. Symptoms of poisoning by this plant are colic, constipation, tympanites in cattle, and raging fits of fury in horses. In India a medicine and illuminant are obtained from the yellow acrid oil expressed from the seeds.

Lolium temulentum (darnel, poison darnel, ivray, bearded darnel, sturdy ryle, tare, drunk, drawke, dragge, neale, cheat). Native of Europe and Asia Minor, naturalized in various parts of eastern and central North America, abundant on the Pacific coast of North America. The toxic principle is loliine, causing eruptions, trembling, and confusion of sight in man and flesh-eating animals and very strongly in rabbits, but does not effect swine, horned cattle, or ducks. It is said to produce intoxication in man, beasts, and birds, and brings on fatal convulsions. It is now believed that the poisonous principle is secreted by - and the poisonous properties therefore due to - a parasitic fungus, Endoconidium temulentum, in the spikelets. The reports of some investigators to the effect that darnel is not poisonous are probably the result of using non-infected plants. F

2. Deliriants. Symptoms: spectral illusions; delirium; dilated pupils; thirst; dryness of the mouth; incoördination; occasionally paralysis and tetanoid spasms. Plant families: *Solanaceae*, *Linaceae*, *Dipterocarpaceae*, *Cannabinaceae*, *Menispermaceae*.

Datura stramonium (thornapple, devils-apple, devils-trumpet, dewtry, jamestown-weed, jimsonweed, stinkweed, apple-peru, stramonium, peru-apple, mad-apple, jamestown-lily, fireweed). Native to tropical regions, but widely naturalized in eastern and central North America and Europe. The toxic principles are atropine, hyoscyamine, and hyoscine, but also included are daturine and scopolamine. These alkaloids occur in all parts of the plant, but the seeds are the most toxic. A child of 5 in Newark, N. J., ate freely of a halfgrown capsule of this plant and died the next morning. In 1897 several boys died in New York City from eating this plant's leaves and fruit, one in a state of wild delirium. Even sucking the long attractive flowers or playing with the flower in one's mouth may cause poisoning. Symptoms of large doses are headache, vertigo, nausea, extreme thirst, dry burning skin, general nervous confusion, dilated pupils, loss of sight and of voluntary motion, sometimes mania, convulsions, and death. In smaller amounts the effects are those of general narcotics. Since vomiting is not a common symptom, the stomach contents must immediately be removed by means of a stomach-pump or by strong emetics; then wash out the stomach with strong tea, tannic acid, or an infusion of oak bark, and administer stimulants such as hot strong coffee [brandy was formerly recommended]; pilocarpine and licorice are recommended to counteract the drying effect on the secretions, and prolonged artificial respiration must often be resorted to in order to maintain blood aeration.W F Cattle, horses, and sheep have been poisoned by feeding on the tops of these plants.

Datura alba, *D. stramonium* var. *tatula*, *D. metel*, *D. meteloides*, *D. fastuosa*, *D. ferox*, *D. ceratocaulis*, *D. suaveolens*, and other members of this and the often-segregated genus *Brugmansia* all have similar properties and are widely distributed over the world, including tropical, subtropical, and montane regions. *Brugmansia* is common in Andean Peru, Ecuador, and Colombia.

Hyoscyamus niger (common henbane, common henbell, black henbane, hogs-bean, fetid nightshade, insane-root, belene, chenile, henbane, poison-tobacco). Native of Europe, especially of the Mediterranean region; widely naturalized in North America; cultivated for ornament. The toxic principles are hyoscyamine and hyoscine; also included is pseudohyoscyamine. The henbane is a wellknown medicinal plant. Hyoscyamine is an anodyne and hypnotic, closely resembling atropine in composition and action. It is most abundant in the seeds of the plant. It causes dilation of the pupils. Hyoscine is a powerful depressant of the cerebrum, respiratory center, spinal reflex centers, and motor tract. Thirty-two millegrams act within 15 minutes; 64.8 would be a fatal dose. The roots of the plant are more poisonous than the leaves. Many cases of children being poisoned by henbane seeds are recorded. F

Hyoscyamus albus, *H. muticus*, and *Duboisa myoporoides* have similar properties. The two former are Mediterranean plants, while the latter, along with other members of its genus, are Australian and contain duboisine, a mixture of hyoscyamine and atropine producing an action like that of *Hyoscyamus* but more hypnotic.

Solanum tuberosum (potato, common potato, Irish potato, Idaho potato). A native of the temperate Andes from Colombia to Chile, widely introduced and now cultivated for food throughout the world. The wilted green stems and leaves are poisonous, containing solanine. The water from boiled potatoes contains a poisonous substance. Some persons cannot eat potatoes because they react to them as to a poison. Some investigators maintain that healthy cultivated potatoes now contain no solanine, but diseased potatoes do. Solanine is apparently a conversion-

product. Potato skins are poisonous to some, but are widely eaten by the poor.

Solanum crispum, *S. bahamense*, *S. carolinense*, *S. verbascifolium*, *Lycopersicon esculentum*, *Scopala atropoides*, *S. japonicum*, and related species all have the same or similar properties. The related genus *Capsicum* (including Cayenne, bird, long, and chili pepper) contains capsaicin and capsacutin and also a volatile alkaloid resembling coniine. Death has occurred from use of too much cayenne pepper. In domestic animals it causes gastro-enteritis. F

Solanum dulcamara (woody nightshade, bittersweet, felonwort, felonwood, felonwort mortal, climbing nightshade, bitter nightshade, blue bindweed, dogwood, fellenwort, poisonflower, poisonberry, snakeberry, scarletberry). This is native to Europe and Asia, but now widely naturalized in eastern and central North America and cultivated for ornament. The toxic principles it contains are solanine, dulcamarine, solanidine, and solanein. The berries are the most toxic part of the plant; the leaves less so. It is a narcotic poison when consumed in large doses, even causing death to rabbits that happen to eat of its leaves. In man it produces a certain amount of cerebral disturbances of a narcotic nature, together with dryness of the throat and sometimes a red eruption of the skin and a tendency to diaphoresis.

Solanum nigrum (black nightshade, garden nightshade, houndsberry, petty morel, deadly nightshade, morel, duscle). Widely distributed almost throughout the world. The species includes many races. Its taxonomy is not yet completely worked out. It is probable that the material so called includes several or many closely related species and varieties. The toxic principles are solanine and solanidine, present mostly in the unripe fruit. In general, musky-odored plants are the most dangerous. Some garden races (known as stubbleberry, morelle, garden-huckleberry, wonderberry, and sunberry) have edible fruit which is often sold on the market as huckleberries, but even of these not fully ripe fruit should be eaten with extreme caution. The characteristic symptoms of poisoning by this plant are about the same in men and animals: stupefaction, staggering, loss of speech, feeling, and consciousness, cramps and sometimes convulsions; the pupils of the eyes are generally dilated. Death is rare, but may occur through a paralysis of the lungs. F W

Mandragora officinalis (also called *M. vernalis*; common mandrake, medicinal mandrake, devils-apples, love-apples). This is a native of the Mediterranean region, containing the medicinal principle mandragorine. It is said to have aphrodisiac properties. W

Atropa belladonna (belladonna, banewort, black-cherry, deadly nightshade, dwale, dway-berries, great-morel, naughty-mans-cherry). This is a native of southern Europe and Asia Minor. The toxic principles contained are atropine, hyoscine, atropamine, and belladonnine. The roots often contain from 4/10th to 1 percent of the poison and the leaves about half as much. The greatest amount of the alkaloids occurs in the plant during the flowering period. W F

Erythroxylon coca (coca bush, spadic bush). A native of South America. The toxic principles it contains include cocaine and six lesser-known ones -- cinnamylcocaine, truxilline, benzoylecgonine, tropa-cocaine, hygrine, and cusohygrine. Cocaine applied to mucous membranes produces perfect local anaesthesia; in the mouth is anaesthetizes the gastric mucous membranes and lessens appetite and sometimes stops vomiting. In toxic amounts it acts as a paralyzant -- the respiratory centers are first stimulated and the breathing made deeper and quicker, but depression and paralysis of the respiratory centers follows, cyanosis supervenes and respiration becomes shallow and irregular; death occurs from asphyxia, often very quickly. Treatment consists of rapidly acting stimulants, such as nitroglycerin on the tongue,and strychnine or atropine subcutaneously [brandy subcutaneously was formerly recommended]. F

Linum catharticum (also called *Cathartolinum catharticum*; purging flax, fairy flax, dwarf flax, fairy-lint, mill-mountain). A native of Europe and the Orient. The toxic principle contained is lininarin; said to be very purgative.

Dryobalanops camphora (also called *D. aromatica*; camphor-tree). A native of Borneo, Sumatra, and Ceylon. Contains the toxic principle borneol.

Rosmarinus officinalis (rosemary) and *Ledum palustre* (labrador-tea) also contain borneol; the former also contains camphine.

Cannabis sativa (hemp, redroot, common hemp, indian hemp, bhang, fimble, gallow-grass, neckweed, marijuana). A native of Europe and Asia, now widely distributed in all temperate regions of the world. The toxic principles contained are oil of hemp and trigonelline; included also are cannabin, cannabinol, and cannabin hybrid. Native names in India include majun, charras, and hashish. Cannabin crystallizes in needles and acts like strychnine; cannabinol has intoxicating properties and is obtained from the epidermal glands; cannabin hybrid has a coniine-like odor and causes depression, epilepsy, vertigo, congestion, followed by cephalalgia, earache, toothache, dryness of mouth, throat, lips, and eyelids, vomiting after coffee, palpitation of the heart, weakness of the limbs, and dreaminess during sleep. It produces the same symptoms in animals.

Anamirta paniculata (also called *Menispermum cocculus* and *Cocculus indicus*). Native of India and the Malay peninsula. The toxic principles contained are picrotoxin, curarine, and trigonelline; included also are menispermin and picrotin. This plant is used by aboriginal natives as a fish-poison and to destroy vermin. Similar alkaloids are derived from other members of the *Menispermaceae*, used as arrow-poisons by South American amerinds, notably species of the genera *Abuta*, *Cissampelos*, *Chondodendron*, *Sciadotenia*, *Anomospermum*, *Elissarrhena*, and *Telitoxicum*. The pharmaceutical product curare is derived in large part from these tropical American lianas and acts as a paralyzant, useful in the treatment of spastic complaints.

Trigonella foenum-graecum (fenugreek) also contains trigonelline.

3. Inebriants. Symptoms: excitement of the cerebral functions and of the circulation; loss of the power of coördination and of muscular movements, with double vision; leading to profound sleep and deep coma. Plant families: *Fabaceae*, *Carduaceae*.

Piscidia erythrina (jamaica-dogwood, fish-poison-tree). Native to the West Indies and tropical America, and widely employed as a fish-poison there. The toxic principle is piscidine. *P. carthaginensis* and other species of the genus have the same property.

Artemisia pauciflora (also called *A. lercheana*; wormseed, santonin). A native of Scandinavia. The toxic principle is santonin, found chiefly in the flowers. This toxin occurs also in the related *A. cana*.

Artemisia maritima (sea wormwood, garden cypress). A native of Europe; contains the toxic principle artemisin.

Artemisia absinthium (common wormwood, absinth, old-woman, madderwort, mugwort, mingwort, warmot, boys-love). A native of Europe, now widely naturalized in North America. The toxic principle is absinthic acid. Excessive quantities cause first mental stimulation, followed by a gradual atrophy of the mental faculties, delirium, and even death. Small amounts are added to wine to make vermouth. F

Artemisia abrotanum (southernwood, lads-love, boys-love, slovenwood, oldman, sweet-benjamin). Native to continental Europe; contains the alkaloid abrotanine.

II. Those acting on the spinal cord.

4. Convulsives. Symptoms: clonic (intermittent) spasms extending from above downward; the body bends backwards very violently and becomes rigid (opisthotonos), but lockjaw (trismus) very rare; swallowing spasmodic; death usually in less than 3 hours, or rapid recovery. Plant family: *Loganiaceae*.

Strychnos nux-vomica (nux-vomica tree, poison-nut, crow-fig, kachita, koochie tree). Native to southern India, Java, and the East Indies. Toxic principles are strychnine and brucine, found chiefly in the seeds, but also in the bark and roots. Strychnine poisoning differs from tetanus in the fact that muscular rigidity is continuous in tetanus and the jaw is most effected, while in strychnine poisoning the muscular rigidity disappears more or less (if not completely) between the convulsions and the body rather than the jaw is most effected. The treatment consists of the use of chemical antidotes, such as iodine and its salts or tannic acid; animal charcoal and emetics or the stomach pump before absorption has taken place. The best physiological antidote is chloral in large doses per rectum. F

Strychnos toxifera, *S. guianensis*, *S. castelnaeana*, *S. trinervis* (curare, curari, urari, wourali, arrow-poison). Natives of the Amazonian region of the Guianas, Brazil, and Peru and of adjacent regions. These contain the deadly principles strychnine, brucine, and curarine, as well as loganine, protocurine, tubocinarine, and curine. Curare is one of the deadliest poisons known to man. A small quantity in the blood stream will paralyze the nerves almost instantly and soon cause death. It is used as an arrow-poison by the Amerinds of South America. The active components of curare do not exist pre-formed in the plants used in its preparation. These substances are quaternary ammonium compounds formed during the concentration process of plant extracts. For obtaining active curare it is necessary to use 3 different kinds of plants: (1) those containing alcoilable alkaloids, (2) those which make the medium alkaline during the concentration of the percolates, thus liberating the alkaloids from their natural combinations, and (3) those containing methyl, ethyl, amyl, etc., esters that give the alkyl radical to combine with the alkaloids contained in the first group of plants, forming the active quaternary ammonium compound. Quite a few different plants can furnish the alkaloids, for example, in the *Loganiaceae* from the genus *Strychnos*, in the *Menispermaceae* from the genera *Chondodendron*, *Elissarrhena*, *Anomospermum*, *Sciadotenia*, *Telitoxicum*, *Abuta*, *Cocculus*, and *Cissampelos*, in the *Lauraceae* from the genus *Nectandra* and others, and possibly from species in the *Solanaceae* and other families. There are also quite a few plants that are able to alkalize the medium, the more commonly used being species of *Arum*, *Dieffenbachia*, *Melothria*, *Cyclanthera*, *Clavija*, *Piper*, and *Ipomoea*. Among plants that are able to furnish the esters necessary to the alkylation the most commonly used are species of *Aristolochia*, *Annona*, *Duguetia*, *Xylopia*, *Zingiber*, *Petiveria*, *Gallesia*, *Ocotea*, and *Fagara*. Various essential oils can also be used. Consequently the composition of curare can be greatly varied at will. Some Amerinds add other plants than those mentioned above to their curare, some containing toxic substances of different constitution and others containing anesthetic substances. F

Strychnos ignatii (St. Ignatius bean), *S. tieute* (false upas-tree, upas radja, pokroe, tshettik, tieute), and *S. colubrina* (also called *S. ligustrina*; East Indian snakewood) are natives of the Philippines, Java, Timor, India, and adjacent areas. They contain strychnine and brucine and have similar properties and uses as the South American species. F

Fagraea lanceolata (also called *Potalia lanceolata* or *Nicandra lanceolata*). This is a native of Java. It contains strychnine, brucine, and possibly akangine.

Gelsemium sempervirens (also called *G. nitidum* and *Bignonia sempervirens*; gelsemin, Carolina jasmine, wild jessamine, false yellow jasmine, yellow jessamine, Carolina wild woodbine, evening-trumpetflower). A native of the southeastern U.S.A. to Texas, Mexico, and Guatemala, mostly near the coast. The toxic principle is gelsemine, contained chiefly in the roots. It is useful in medicine, and poisoning is due

usually to overdoses. Symptoms in animals are muscular weakness, staggering gait and falling, followed by convulsive movement of the head and legs; respiration slow and feeble; temperature reduced, sweating, and death because of respiratory failure. In man the symptoms are nausea, pain in the brows and eyeballs, dilation of the pupils, paralysis, and dimness of vision. The plant also contains gelseminine.

Spigelia marilandica (also called *Lonicera marilandica*; indian-pink, caroline-pink, wormgrass, pinkroot, star-bloom). A native of central and southeastern U.S.A.; cultivated in Europe and elsewhere. The toxic principle is spigeline, a volatile alkaloid resembling coniine. It is a powerful anthelmintic. When taken in overdoses it excites the circulation, causes dimness of vision, vertigo, dilated pupils, spasms of the facial muscles, and general convulsions followed by death. It is especially fatal to children. F

III. Those acting on the heart.

5. Depressants. Symptoms: vertigo, vomiting, abdominal pain, confused vision, convulsions, occasional delirium, paralysis, fainting or sudden stoppage of heart action (syncope), sometimes asphyxia. Plant families: *Solanaceae*, *Ammiaceae*, *Lobeliaceae*, *Fabaceae*, *Rutaceae*, *Rubiaceae*.

Nicotiana tabacum (tobacco, Virginian tobacco-plant, common tobacco). It is native to North America, now widely cultivated in various parts of the world. The poisonous principle is nicotine. This occurs to the extent of 6 percent in the dry leaves and is said to have 16 times the toxic power of coniine. Heat changes nicotine to pyridine and picoline. Pyridine depresses the spinal motor tract and causes paralysis of respiration; moderate amounts cause contraction of the pupils. Other alkaloids included are nicoteine, nicotemine, and nicotelline. Nicotine is one of the most powerful and rapidly acting poisons. Treatment consists of evacuation of the stomach; use of tannic acid; respiratory and heart stimulants like strychnine, atropine, and alcohol; external heat; and artificial respiration. F

Nicotiana repanda, *N. rustica*, *N. quadrivalvis*, *N. suaveolens*, and other species contain the same substances and should also be avoided.

Conium maculatum (hemlock, poison-hemlock, snakeweed, St. Bennets-herb, cashes, wode-whistle, poison-parsley, spotted-parsley, bunk). This is a native of Europe, now widely naturalized in the U.S.A., Mexico, and South America. The toxic principles are conine (coniine) and coniceine, also conydrine, pseudoconydrine, and methylaconiine. This is a very poisonous plant used by the classical ancients to poison criminals that were condemned to death; Socrates was executed thus. It is especially dangerous because its seed is sometimes mistaken for and eaten for anise, its leaves for parsley, or its roots for parsnips. The hollow stems are often used by children to make blowpipes or whistles, with terrible effects on the mouth and throat. Many domestic animals have been killed by eating the plant, with loss of appetite, salivation, bloating, much bodily pain, loss of muscular power, and rapid feeble pulse. In man there is a general and gradual weakening of muscular power; the power of sight is often lost, but the mind usually remains clear until death ensues from gradual paralysis of the lungs. 2.3 grains is a fatal dose. W F

Lobelia inflata (indian-tobacco, asthmaweed, emeticweed, wild-tobacco, eyebright, gagroot, pukeweed, lowbelia, bladder-pod lobelia). A native of the eastern U.S.A. and Canada; cultivated in Europe. Its toxic principle is lobeline; also included are lobelic acid, lobelacrin, and inflatine. Overdoses cause nausea, vomiting and great prostration, stupor, coma, convulsions, and death. F

Lobelia urens, *L. nicotianaefolia*, *L. purpurascens*, *L. breynii*, *L. siphilitica*, *L. cardinalis*, *L. spicata*, and other species are said to have similar properties, although in much less degree.

Cytisus scoparius (also called *Spartium scoparium* and *Sarothamnus scoparius*; broom, green broom, Scotch broom, hagweed, bannal, besom). A native of

Europe; widely cultivated and now naturalized in many parts of North America. The toxic principles are sparteine and cytisine. A single drop of the former can kill a rabbit. One worker records 400 cases of poisoning from this plant. The substance occurs in other related genera like *Laburnum*, *Ulex*, *Sophora*, *Thermopsis*, *Baptisia*, *Anagyris*, *Lotus*, *Colutea*, and *Euchresta*.

Physostigma venenosum (calabar-bean, chop-nut). A native of western Africa. The toxic principles contained are eserine, calabarine, erythrophloeine, muawine, and physostigmine.

Erythrophlaeum guineense also contains erythrophloeine, a poison which acts like digitalin and picrotoxin.

Pilocarpus pennatifolius (jaborandi). A native of Brazil. Its toxic principles are pilocarpine, japorine, and pilocarpidine. Pilocarpine is a powerful diaphoretic. An antidote for pilocarpine poisoning is atropine.

Ruta graveolens (common rue, countrymans-treacle, ave-grace, herb-of-grace, herb-of-repentance). A native of continental Europe and formerly of Asia Minor; cultivated throughout the world. Its toxic principles are oil of rue and euodic acid. The rue plant has a strong disagreeable odor, is so acrid that it will blister the hands, and contains an acrid narcotic poison.

Evea ipecacuanha (also called *Cephaëlis ipecacuanha* and *Psychotria ipecacuanha*; ipecacuanha, ipecac). This is a native of Brazil, containing the toxic principles emetine and cephaëline. These are emetic, with a nauseous odor and a repulsive bitter taste. A native name is ipe-caagoene.

Asclepias asthmatica also contains emetine.

6. Asthenics. Symptoms: numbness and tingling in the mouth; abdominal pain, vertigo, vomiting, purging, tremor, occasional delirium, paralysis; difficulty in breathing (dyspnoea), ending in fainting or sudden stoppage of heart action (syncope). Plant families: *Amygdalaceae*, *Fabaceae*, *Ranunculaceae*, *Apocynaceae*, *Urticaceae*, *Moraceae*, *Scrophulariaceae*, *Liliaceae*, *Convallariaceae*, *Melanthiaceae*.

Laurocerasus officinalis (also called *Prunus laurocerasus*, common laurel, cherry-bay, cherry-laurel). A native of the area from southeastern Europe to Iran. It contains the toxic principle amygdalin, yiedling prussic acid.

Prunus amara (bitter almond). A native of Asia and perhaps also the Mediterranean region. It contains prussic acid. F

Prunus americana, *P. avium*, *P. claudiana*, *P. insititia*, *P. lusitanica*, *P. spinosa*, *P. domestica*, *Padus avium*, *P. virginiana*, *P. nana*, *Amygdalus persica*, *Armeniaca vulgaris*, *Lotus arabicus*, and *Laurus nobilis* also contain prussic acid, especially in the seeds and the wilted leaves. Wilted leaves are especially dangerous, but fresh leaves are also poisonous, for the character of the digestive juices in the stomach are such as readily to change the amygdalin of fresh leaves into hydrocyanic acid. Apple seeds (*Malus pumila*) contain this, too. F

Phaseolus lunatus (hibbert bean, sugan bean, lima bean, lima kidney bean, pois-d'achery, Java bean, haricot du cap). This is a native of South America, but is now universally cultivated. Almost all varieties, whether wild or cultivated, contain the substance (phaseolunatin) which when acted upon by an enzyme yields hydrocyanic (prussic) acid. The proportion of toxic principle varies from almost none in improved cultivated lima beans to as much as 320 mg. per gram of dry weight of certain Java beans. Prolonged boiling extracts the greater part (but not all), but if the water is again absorbed the danger returns, since the beans themselves either in the alimentary tract or the blood are sufficient ferments to act upon the dissolved glucosides resulting in the liberation of hydrocyanic acid.

Lathyrus aphaca (yellow vetchling, yellow-flowered pea). This is a native of Europe and the Orient. It contains prussic acid, as do also the related *L. cicera* and *L. clymenum*.

Adonis vernalis (ox-eye, spring adonis). A native of central and southeastern Europe, containing the toxic principle adonidin. This poison is found also in *A. amurensis*, *A. aestivalis*, *A. cupana*, and other species of the genus.

Aconitum napellus (monkshood, monks-cowl, common aconite, wolfsbane, venuschariot, bearsfoot, helmetflower, luckies-mutch, friarscap, soldierscap, turkscap). A native of Europe containing the deadly principle aconitine in its stems and leaves and especially in its roots. Contained also are pseudoaconitine and aconine. One worker records 86 fatalities in Europe, of which 2 were cases of murder, 7 suicides, and 77 more or less accidental deaths from this plant -- 6 were from the action of the alkaloid alone, 10 from eating of the root, in 2 cases children ate the flowers, in one case the leaves of the plant were cooked and eaten by mistake, in 7 cases the tincture was mistaken for brandy, sherry, or liquor, and in the remainder of the cases the tincture, liniment, or extract was used. W F

Aconitum ferox (bish-poison, indian-aconite, Nepaul aconite). A native of India and the Himalaya mountains, containing pseudoaconitine. It is used as an arrow-poison. Other species containing this toxic principle are *A. arctophonum*, *A. cammarum*, *A. lagactonum*, *A. lycoctonum*, *A. meloctonum*, *A. myoctonum*, and *A. vulparia*.

Aconitum deinorrhysum contains japaconitine.

Aconitum spicatum contains bikhaconitine.

Aconitum chasmanthum contains indaconitine.

Eranthis hyemalis (winter aconite, winter hellebore, winter wolfsbane). A native of Europe, containing the toxic principle aconitine. It is widely cultivated for ornament.

Actaea spicata (herb-christopher, baneberry, grapewort). A native of Europe, containing the toxic principle oil of baneberry. Sheep are occasionally poisoned through eating the leaves. The root and fruit are also poisonous, being violet purgatives, irritants, and emetics. The related American species, *A. alba*, *A. rubra*, and *A. pachypoda*, have similar properties.

Delphinium staphisagria (staves-acre, lousewort). This is native from Italy and Greece to Asia Minor. Its toxic principles are delphinine, delphisine, and delphinoidine, as well as staphisagrine and calcitripine. W

Delphinium consolida (wild larkspur, branching larkspur, dolphinflower, kings-consound, knightspur). This is a native of Europe. It contains the same toxic delphinine, delphisine, and delphinoidine, as does also *D. exaltatum* of Alaska. Other species containing these poisons are *D. trollifolium*, *D. belladonna*, *D. elatum*, *D. cheilanthus*, *D. bicolor*, *D. glaucum*, and many other species of temperate Europe, Asia, and North America -- many of which are widely cultivated in flower gardens.

Nerium oleander (oleander, common oleander, rosebay, dogbane, south-sea-rose). This is a native of the Levant, widely cultivated in tropical and subtropical regions and in greenhouses or tubs elsewhere; naturalized in southern Europe and in warmer parts of the world. It contains the deadly oleandrine and rosaginin. The whole plant is poisonous. Soldiers in Spain were poisonous through having their meat roasted on spits made of this wood. It acts as a heart stimulant similar to digitalis. Dr. Van Dellen reports that a soldier "became deathly ill after plucking a flower from an oleander bush and sucking on the broken end. He started vomiting violently within a few minutes and his skin turned pale and his lips cherry red. At the camp hospital he complained of 'burning up inside' and tore at his clothing trying to obtain relief." Had more of the toxin been consumed he would have developed colic, dizziness, bloody diarrhoea, irregularity of the heart, and respiratory paralysis ending in death. A chemical obtained from this plant is used in Europe as a rat poison. F

Aspidosperma quebracho-blanco (quebracho). A native of Argentina, containing aspidospermine, aspidospermatine, quebrachine, aspidosamine, quebrach-

inamine, and oleandrine.

Strophanthus kombe (white-woolly kombe-bean, Gaboon arrowpoison, kombé) and *S. hispidus*. These are natives of western Africa, containing the toxic strophanthine which acts like digitalis and is used there as an arrow-poison. Ineine (or incine), formerly thought to be contained in these plants, has now been shown to be merely a case of faulty chemical isolation. *S. sarmentosus* is thought to be the source of a precursor of cortisone, useful in the treatment of arthritis and similar ailments.

Tanghinea venenifera (also called *T. venosa* and *Cerbera tanghin*; ordeal-tree, poison tanghin). This is a native of Madagascar, whose seed is extremely poisonous, containing tanghinin and cerberin. It is used by the natives to poison persons, and formerly criminals were put to death by being pricked with a lance dipped in the juice of the kernel of this plant. A single seed is said to contain enough poison to kill 20 people. F

Thevetia neriifolia (yellow oleander). A native of Brazil, containing two powerful heart poisons, thevetin and theveresin.

Antiaris toxicaria (upas-tree, antsjar, pohon-upas, hypo, Malay arrow-poison). A native of Java, Borneo, Sumatra, and the Philippines, containing the toxic principle antiarin. It is used as an arrow-poison in these areas. It acts on the brain and respiratory nerves, causing vomiting and loss of sensation.

Urtica pilulifera, *U. crenulata*, *U. urentissima*, *U. gigas*, *U. dioica*, *U. urens*, and other species of nettles, found over most temperate parts of the world. They contain formic acid, producing urticaria. The related genus *Laportea* (or *Urticastrum*) is even more virulent, found mostly in warm countries, with but a single species in the U.S.A.

Ficus roxburghii (also called *F. daemona* and *F. toxicaria*). A native of India, containing an acrid milk.

Digitalis purpurea (common foxglove, throatwort, bloody-finger, dead-mens-bells, fairy-fingers, fingerflower, flapdock, lusmore, purple foxglove, thimbles, fairy-cap, folks-glove, fairy-thimbles, fairyweed, fairy-bells, popdock, popglove, rabbits-flower, cottagers, lionsmouth, scotch-mercury, lady-fingers, lady-glove, lady-thimble, dogs-finger, witches-thimbles). A native of western Europe, widely cultivated for ornament elsewhere, naturalized in many parts of North America. It contains the toxic principles digitalin, digitoxin, and gitalin, as well as digitalein, digotinin, digitophyllin, and luteolin. Death may ensue in a few hours or after several days. F

Digitalis lutea contains the same toxic substances.

Linaria vulgaris (common toadflax, yellow toadflax, wild-flax, butter-and-eggs, buttered-haycocks, eggs-and-bacon, dragon-bushes, flaxweed, gall-and-wormwood, gallwort, ramsted, bridesweed, impudent-lawyer, jacobs-ladder, rancid, wild-tobacco, devils-flax, snapdragon, devils-flower, dead-mens-bones, bread-and-butter). A native of Europe and Asia, now widely naturalized in North America. The toxic principles contained are gratiolin and linarin.

Gratiola officinalis (hedge-hyssop, poor-mans-herb). A native of southeastern Europe, containing the toxic principle gratiolin. It is poisonous to stock and overdoses are poisonous to man

Hymenoxys odorata (poison-bitterweed). This is said to be the champion sheep-killer of Texas.

Urginea scilla (also called *U. maritima*; medicinal squill, sea-onion). A native of the Mediterranean area and southern Africa, containing scillitoxin and scillipicrin. These are contained also in *U. altissima*, *Scilla indica*, *Agapanthus umbellatus*, and *Crinum asiaticum*. The sea-onion is much used as a rat-poison.

Scilla bifolia (two-leaved squill, early spring squill), *S. amoena*, *S. autumnalis*, *S. brachyphylla*, *S. campanulata*, *S. corymbosa*, *S. fraseri*, *S. lilio-hyacinthus*, *S. patula*, *S. peruviana*, *S. siberica*, *S. taurica*, and *S. verna*. These bulbs contain the toxic narcissine, used as a

rat poison, causing cerebral convulsions and erysipelas.

Convallaria majalis (common lily-of-the-valley, may-lily, mugget, convallily, liricon-fancy). A native of Europe, Asia, and apparently also the Allegheny mountains in the U.S.A. It contains the toxic convallamarin and convallarin. The former acts like digitalin, while the latter is a purgative. The action of the heart is infrequent and irregular, and finally death occurs from paralysis. The Asiatic and American forms may prove distinct and may then be separated as *C. japonica* and *C. majuscula*. F.

Schoenocaulon officinale (sabadilla veratrina, cevadilla). A native of South America, containing the toxic principles veratrine and cevadine.

Veratrum album (also called *Asagraea officinalis*; white-flowered white hellebore, langwort, lyngwort). This is native to the Alps mountains of Europe. It contains the toxic veratrine, cevadine, veratrone, and jervine, as well as veratridin, sabadillin, sabadin, sabadinin, rubijervine, pseudojervine, protoveradine, protoveratradine, and veratamarin. The roots, leaves, and seeds are poisonous, with an effect like that of aconite, being directed chiefly against the action of the heart and spinal cord, both of which become paralyzed. *V. viride*, *V. nigrum*, and *V. californicum* have similar properties. Symptoms of poisoning by these plants are burning in the throat with increased salivation, producing a weak pulse, labored respiration, and profound prostration. Deaths in New Jersey have been attributed to *V. viride*. W F

Colchicum autumnale (common meadow saffron, meadow crocus, autumn crocus, Michaelmas crocus, purple crocus, fog crocus, naked-ladies). A native of Europe and northern Africa, containing the toxic principle *colchicine*, also contained in *C. speciosum*. F

IV. Irritant poisons.

7. Purgatives. Symptoms: abdominal pain, vomiting and purging, cramps, painful muscular spasms (strangury) and strain (tenesmus) during urination and defecation, followed by collapse, and sometimes accompanied by drowsiness and slight nervous symptoms. Plant families: *Aloaceae*, *Cucurbitaceae*, *Clusiaceae*, *Convolvulaceae*, *Euphorbiaceae*, *Ranunculaceae*.

Aloë socotrina (also known as *A. succotrina*; socotrine aloes tree). A native of southern Africa, containing 4 to 10 percent of the bitter purgative principle aloin, and also some emodin.

Aloë barbadensis, *A. ferox*, *A. vera*, *A. tenuior*, *A. spicata*, *A. saponaria*, *A. chinensis*, *A. arborescens*, *A. africana*, and *A. abyssinica* also contain aloin and are purgatives. They are natives of the Mediterranean region, South Africa, China, and Australia.

Ecballium elaterium (also called *Momordica elaterium*; squirting-cucumber, wild cucumber). A native of southern Europe and the Orient, cultivated elsewhere. The toxic principle contained is elaterin, a powerful hydragogue cathartic and irritant poison. Its poisonous nature was known to Pliny.

Erythrophloeum guineense (casca-bark, sassy-bark, ordeal-bark). It is a native of Sierra Leone, containing an acrid juice with erythrophlein which acts like digitalin and picrotoxin.

Garcinia cambogia (gamboge-tree). A native of India, Siam, and Cochinchina, containing the toxic principle cambogin.

Exogonium purga (also called *Ipomoea purga*; jalap-plant, morning-glory). A native of western Mexico, containing the toxic principle convolvulin.

Ipomoea turpethum, *I. leptophylla*, *I. fastigiata*, and *Pharbitis purpurea* (also called *I. purpurea*) have similar properties in their large roots, the first- and last-mentioned containing convolvulin and the others the purgative glucoside ipomoein.

Convolvulus scammonia (scammony). A native of western Asia, cultivated elsewhere, including Europe. The hardened milky juice contains jalapin and scammonin.

Convolvulus orizabensis, of Mexico, also contains jalapin.

Croton tiglium (croton-oil-plant, kamaísa, kamágsa, kemáde, makaísa, túba,

tjerákin, similákian, kemalákijan, édal-édal, pentjáhar, rúngkou, dúngkow, lúngkow, lánta, kelmúre, túpo, humulíte, semúli, kówe). This is a native of the East Indies. It contains the toxic principles crotonol, crotonoleic acid, and tiglinic acid, as well as crotonic acid. The plant (especially the seeds) is a veryviolent and drastic purgative, capable in excess of causing death. It is used as a fish poison. The resin produces vesication.

Croton verreauxii and *Codiaeum variegatum* also contain crotonol and crotonoleic acid. Juice from the second-mentioned species often produces blisters on contact with the skin.

Ricinus communis (castoroil-plant, castor-bean, palma-christi, agalíva, djárak, tángan-tangan, lúlang, dúlang, lajéndru, rángam, kalíki, taténga, lólo, ketówang, kolnjan, alále, kilále, tilalóngi, lúlu, balátjai, tuituipakarángi). A native of the Belgian Congo and western Africa, now widely cultivated and naturalized throughout tropical and subtropical regions. Castor oil is a mild and safe purgative containing ricinolein, palmitin, stearin, and myristin. It is not poisonous, but the pulp of the seeds after the oil has been extracted contains an acrid albuminous substance, ricin and ricinone, which is very poisonous. These seeds are 10 times more purgative than the oil; 3 seeds have caused death in man. The seed, eaten accidentally by horses and sheep, has caused death to these animals. A poorly done job of extracting the oil may include some pulp with the oil and thus render it poisonous. Animals may be rendered immune with a serum and can then eat the seeds with impunity. A young lady had her eyes inflamed from contact with just a trace of the substance in a laboratory. F W

Ricinus sanguineus and other so-called species and varieties have the same properties as the ordinary form of the plant. Dr. Van Dellen says "The extracted oil is a powerful cathartic (castor oil) and an overdose may have a serious effect. But the oil is harmless compared with ricin, a chemical substance found in the uncooked bean. This material is as lethal as rattlesnake venom."

Caltha palustris (marsh-marigold, water-buttercup, meadow-bright, meadow-bout, meadow-gowan, open-gowan, water-gowan, yellow-gowan, may-blobs, boots, golds, goldins, water-dragon, water-blobs, mire-blobs, horse-blobs, meadow-buttercups, American cowslips, spring cowslips, capers, cow-lily, crowfoot, coltsfoot, king-cup, soldiers-buttons, palsywort, great bitterflower, crazy-bet, gools, bullflower, drunkards, water-goggles). A native of Europe and eastern North America; also cultivated for ornament. Its toxic principles are jervine and helleborin, which, however, are completely dissipated by boiling. In America the greens are often used as a pot-herb and the buds are sometimes pickled. Cattle eating of the plant get diarrhoea and milk-stoppage and may die from stomach inflammation. The alkaloid is said to be similar to or identical with nicotine.

Mallotus philippinensis (also called *Rottlera tinctoria*; kamala, kamela). A native of Asia and the East Indies. The fruit contains rottlerin, isorottlerin, and mallotoxin, and is used as a vermifuge.

Podophyllum peltatum (American mayapple, American mandrake, podophyllin-plant, wild-lemon, wild-buckfoot, racoon-berry, may-apple, wild mandrake, indian-apple, hog-apple, devils-apples, ground-lemon, pucks-foot). A native of eastern North America, containing the toxic principles podophyllotoxin, podophyllin, and picropodophyllin, also some berberin and saponin. Cases of poisoning have been reported. It produces fatal prostration. The powdered resin produces ulcers on the skin similar to venereal ulcers. The roots, stems, and leaves are drastic and poisonous, the ripe fruit less so. Cows eating of the leaves of this plant produce injurious milk. F

Podophyllum emodi, the Asiatic species, has the same properties. F

Helleborus viridis (green hellebore, bastard hellebore, bears-foot, boars-foot, christmas-rose, chris-root). A native of Europe; widely cultiva-

ted for ornament in temperate regions; naturalized in parts of eastern North America. Its toxic principles are jervine and helleborin, also helleborein and heleboretin. Helleborin is a highly narcotic powerful poison, causing stupor followed by death with spasms. F

Helleborus foetidus, *H. niger*, *H. orientalis*, and other species also contain the same toxic principles. These plants are originally European or from the Levant, but are widely cultivated for ornament, especially *H. niger*, and thus may be expected anywhere in temperate regions. F

8. Irritants with nerve-symptoms. Symptoms: abdominal pain, vomiting and purging, dilated pupils, headache, tetanic spasms, occasional colvulsions, sometimes rapid coma. Plant families: *Agaricaceae*, *Polyporaceae*, *Boletaceae*, *Phallaceae*, *Ammiaceae*, *Cupressaceae*, *Taxaceae*, *Euphorbiaceae*, *Phytolaccaceae*, *Fabaceae*.

Amanita, *Armillaria*, *Mycena*, *Cantharellus*, *Lactarius*, *Hygrophorus*, *Russula*, *Gomphidium*, *Pleurotus*, *Volvaria*, *Hypholoma*, *Boletus*, *Phallus*, etc. These are widely distributed, almost cosmopolitan, groups of fungi, including some that are mildly poisonous, others that are deadly. General clinical symptoms of poisoning from *Amanita phalloides* (death-cup, destroying-angel), the most famous, are given by Pammel as follows "Often latent period of from 6 to 12 hours during which the victims remain quite well. Then they are suddenly seized with terrible abdominal pain, excessive vomiting and thirst. Diarrhoea may set in with mucous bloody stools, or there may be constipation. The paroxysm of pain may be so severe as to result in a peculiar hippocratic facies [an appearance of the face as just before death; described by Hippocrates]. The patients rapidly lose strength. In 3 to 4 days in children and 6 to 8 days in adults coma develops, from which the patient cannot be aroused. Cyanosis and lowered temperature precedes the fatal exit. Ocular symptoms and convulsions do not ordinarily occur, but convulsions may be present at the terminal event. The mortality varies from 60 to 100 percent." F

Phytolacca americana (also called *P. decandra*; pokeweed, garget, poke, scoke, pigeonberry, inkberry, redweed, red-ink-plant, pocan-bush, coakum, cancer-jalap, American nightshade). A native of eastern North America and Mexico, naturalized in Europe. It contains the toxic acrid alkaloid phytolaccin, as well as phytolaccic acid and the toxic phytolaccotoxin. The toxic parts of the plant are the roots and seeds, although all parts have somewhat narcotic properties. It causes irritation of tender or abraded skin; internally it causes nausea, vomiting, purging, and acro-narcotic poisoning. Mosr instances of poisoning from this plant arise from overdoses in medicine, but accidental cases are due to eating the root (mistaken for parsnip, artichoke, or horseradish). A few deaths of children have been attributed to eating the seeds. F W

Astragalus (locoweed). Many species of this and related genera are natives of the central parts of North America and other dry parts of the world, like Asia Minor and the Orient. They are very dangerous to sheep, horses, and cattle, but principally to horses. The effect is not acute, but in its slow progress stimulates diseases caused by bacteria, worms, or other parasites, or such as are caused in man by the continual use of alcohol, tobacco, or morphine. Two stages are recognized. The first, which may last several months, is a period of hallucination or mania accompanied by defective eyesight, during which the animal may perform all sorts of antics. After acquiring a taste for the plant it refuses every other kind of food, and the second stage is ushered in. This is a lingering period of emaciation, characterized by sunken eyeballs, lusterless hair, and feeble movements. The animal dies as if from starvation in periods ranging from a few months to one or two years. W

Oenanthe crocata (water-hemlock, hemlock dropwort, dead-tongue, belder-root, ben-dock). A native of Europe, containing the toxic principles oenanthin and oenanthotoxin, the latter somewhat similar to cicutoxin. All parts of the plant are poisonous, but most especially the roots. In horses it produces paralysis of the hind legs. F

Oenanthe phellandrium (also called *Phellandrium aquaticum*; horsebane). A native of Europe, containing the toxic oenanthin and phellandrene.

Oenanthe fluviatilis and *O. fistulosa* also contain oenanthin and are irritant poisonous.

Cicuta maculata (cowbane, water-hemlock, spotted-hemlock, musquash-root, spotted cowbane, beaver-poison, childrens-bane, musquash-poison, wild-parsnip, snakeweed). A native of eastern and central North America, containing the toxic oil of cicuta, cicutine, coniine, and cicutoxin. The poison resides in the roots, stems, and leaves, but mostly in the roots. Even dried leaves of this plant mixed in hay will kill calves. Children in the country often dig up the roots and mistake them for artichokes, and many die every year. The convulsions are terrible and continue until death. A typical case is described thus: "His first symptom was a pain in the bowel, urging him to an ineffectual stool, after which he vomited about a teacup of what appeared to be the recently masticated root, and immediately fell back into convulsions which lasted off and on continuously till his death. The doctor found him in a profuse sweat and convulsive agitations, consisting of tremors, violent contractions and distortions, with alternate and imperfect relaxions of the whole muscular system, astonishing mobility of the eyeballs and eyelids, with widely dilated pupils, stridor dentium, trismus, frothing at the mouth and nose, mixed with blood and occasionally violent and genuine epilepsy." F W

Cicuta virosa is the European species with identical properties. F

Aethusa cynapium (fools-parsley, ass's-parsley, dogs-parsley, lesser-hemlock, false-parsley, fools-cicely, dog-poison, small-hemlock). A native of Europe; now naturalized in eastern North America, containing the toxic principle cynapine. This causes stupor, paralysis, convulsions, and death, especially to domestic animals that happen to eat of it. F

Aethusa fatua contains the same substance and is equally dangerous.

Juniperus sabina (savin, savin juniper). A native of Europe and Asia, widely cultivated for ornament in temperate regions of the earth. It contains the toxic oil of savin and sabinol. F

Taxus baccata (common yew, palm, European yew, English yew). A native of Europe, but widely cultivated for ornament in all temperate regions of the world. Its toxic properties are attributed to taxine, oil of yew, and formic acid. The fruit is the most poisonous part of the plant, but many writers assert that the branches and leaves are also poisonous. Pammel says that death may be sudden, resembling apoplexy; it may be preceded by staggering and convulsions; cases of long standing show gastero-enteritis. Use purgatives as a remedy. F

Euphorbia resinifera (euphorbia gum-plant, darkmous, dergmuse). A native of Morocco. It contains the toxic principle euphorbin or euphorbon, which is a purgative and is so intensely acrid that people collecting it are compelled to tie a cloth over their nostrils and mouth.

Euphorbia peplus, *E. pilosa*, *E. helioscopia*, *E. platyphylla*, *E. hiberna*, *E. portlandica*, *E. paralias*, *E. exigua*, *E. lathyris*, *E. amygdaloides*, *E. myrtifolia*, *E. cyparissias*, and other species of this huge genus, including the segregated genera *Galarhoeus*, *Tithymalus*, *Tithymalopsis*, *Lepadena*, etc., all should be avoided because they all contain euphorbin.

Hippomane manchinella (manzanillo, manchineal-tree). Native to the seashores of Central America and the West Indies, where it is quite common. It contains oil of euphorbia, an acrid poison causing blisters, used as an arrow-poison by the Carib Amerinds. A drop placed on the skin feels like a hot iron and soon raises a blister. Negroes place it in streaks on their backs to excite compassion among people who would mistake the blisters for the results of a beating. The fruit resembles a crabapple and was eaten by early Spanish explorers, in some cases with fatal results. The reputation of the tree thereupon became terrible. Popular

belief is that to lie under it will cause blindness or even death. It is said to cause blindness and even death if gotten on the face. The milky sap is certainly highly irritant, causing severe inflammation. Smoke from the burning wood sometimes causes inflammation of the eyes. F

Cameraria latifolia, *Excoecaria agallocha*, and many other members of the spurge family also contain oil of euphorbia. The second-mentioned species is a tropical Asiatic plant which may cause blindness to woodcutters if its juice enters the eyes. *Cameraria* is a plant of the West Indies and tropical America.

Buxus sempervirens (common box tree, common box, boxwood). A native of Europe, now widely cultivated in all temperate regions for ornament. It consists of many named varieties and there are closely related species, all having the same properties. The toxic principles are buxine, buxidine, and oil of euphorbia. The entire plant is an acrid poison. It is sometimes used as a substitue for hops in the making of beer and then leads to serious accidents.

Jatropha curcas (also called *J. urens*; physic-nut, spurge-nettle, djárak-kósta, lau-páta, túba-túba, bindálo, bintálo, úto-papalégi, balátjai, dánar-énde, djírak, kaléke, béaw, bíue, péleng-kalíki, pákie-káse, mouén-máv, malóte, mákamále, ai-kaméne, jáihua-kamálo, bolátjai, kadóto). This is a native of Asia, but has been widely introduced along fences and hedges in all tropical regions, where it is a common shrub. The rather large seeds contain an acrid juice, curcin, which is poisonous and violently purgative. It is often called "Brazilian stinging-nut" and is considered to be one of the most poisonous plants known to men. Its stiff hairs cause great pain to flesh for a day or longer,& even high fevers have resulted.

Manihot utilissima (also called *Jatropha manihot*; tapioca, cassava, mandioc plant). A native of the tropics, it contains substances easily converted into hydrocyanic acid. These are chiefly in the root and can be removed by heating. Natives distinguish varieties of this plant which are poisonous and varieties which are not. It is also called *M. esculenta* (yuca).

Jatropha gosypiifolia also contains similar acrid juice.

Paris quadrifolia (herb-paris, four-leaved-grass, one-berry, true-love). A native of Europe. Its toxic principle is paristyphin, contained in the leaves, roots, and especially in the fruit. This fruit is said to poison chickens which eat it, and to produce gastero-enteritis in man.

Mercurialis perennis (dogs-mercury, herb-mercury, wild-spinach, kentish-balsam). A native of Europe, containing the toxic principles oil of euphorbia, mercurialine, and choline. *M. annua* has the same properties.

Laburnum anagyroides (common laburnum, bean-trefoil, he-broom, false-ebony, golden-rain, golden-chain). A native of continental Europe; widely cultivated elsewhere for ornament. It contains the toxic cytisine. F

Cytisus hirsutus, *C. alpinus*, *Ulex europaeus*, *Sophora tomentosa*, *S. speciosa*, *Thermopsis* spp., *Baptisia tinctoria*, *Anagyris foetida*, *Lotus suaveolens*, *Colutea cruenta*, *Euchresta horsfieldii*, and other related legumes also contain the toxic cytisine.

Andira araroba (goa-powder-tree, araroba, araroba-powder-tree, bahia-powder-tree). A native of Brazil, containing the toxic principles chrysarobin and chrysophanic acid. Many other species of this genus in South America are poisonous as anthelmintics, irritants, and fish-poisons.

9. Simple irritants. Symptoms: burning pain in the throat and stomach, thirst, nausea, vomiting, tenesmus, purging, difficulty in and painful urination (dysuria), difficulty in breathing (dyspnoea) and cough occasionally, convulsions, exhaustion or starvation due to injury to throat or stomach, and death through shock. Plant families: *Araceae*, *Thymelaeaceae*, *Amaryllidaceae*, *Liliaceae*, *Ranunculaceae*, *Cucurbitaceae*, *Oleaceae*, *Aristolochiaceae*, *Caryophyllaceae*, *Carduaceae*, *Balsaminaceae*, *Brassicaceae*, *Boraginaceae*, *Caprifoliaceae*, *Dioscoreaceae*, *Celastraceae*, *Rhamnaceae*, *Papaveraceae*, *Crassulaceae*, *Droseraceae*, *Iridaceae*, *Polygala-*

ceae, Polygonaceae, Plumbaginaceae, Anacardiaceae, Fabaceae.

Zantedeschia aethiopica (also called Richardia africana; white arum, trumpet-lily, lily-of-the-nile, white calla, calla-lily). A native to South Africa, now cultivated for ornament throughout the world, outdoors in tropical regions or in greenhouses in temperate ones, commonly naturalized in Brazil and elsewhere. It contains an acrid juice which can be removed by roasting or boiling of the rhizomes. Other membrs of this genus have the same properties.

Arum maculatum (cuckoo-pint, lords-and-ladies, wild arum, wake-robin, portland-sago, portland starchroot, lamb-in-a-pulpit, jack-in-a-pulpit, lily-grass, mandrake, nightingales, calves-foot, friars-cowl, bulls-and-cows, bobbing-joan, bobbins, bloody-mans-finger, aaron, adam-and-eve, adders-meat, arrowroot). A native of Europe. It contains an acrid juice causing severe dermatitis, paralysis, and in the case of children even death. Birds die of eating the seeds. F

Arum atrorubens, A. crinitum, Anthurium ferrierense, A. candidum, A. divaricatum, A. dracontium, A. dracunculus, A. italicum, A. macrorhizon, etc., also contain the same acrid juice, as does also Philodendron simsii.

Daphne laureola (spurge-laurel, copse-laurel, wood-laurel, dwarf bay). A native of Europe, widely cultivated in temperate regions. Its toxic principle is mezerein, used as a fish-poison in northern Asia. F

Daphne mezereum (common mezereon, mysterious-plant, spurge-flax, spurge-olive, dwarf-bay). A native of Europe and northern Asia, containing mezerein, as does also D. gnidum (spurge-flax, flax-leaved daphne) from southern Europe.

Narcissus moschatus (musk-scented daffodil), N. poeticus (poets-daffodil, poets-narcissus, whitsun-lily), N. johnstonii (queen-of-spain), N. pseudonarcissus (affadil, averil, bell-rose, bul-rose, common double daffodil, trumpet daffodil, crow-bells, chaliceflower, daffidowndilly, lent-lily, lent-rose), N. polyanthus (also called N. tazetta; polyanthus narcissus, French daffodil), and other species of this genus, mostly natives of Europe but widely cultivated for ornament in all temperate regions of the earth, contain the toxic principle narcissine, producing intense gastero-enteritis. The toxin is concentrated in the bulbs.

Galanthus nivalis (common snowdrop, candlemas-bells, bulbous-violet, fair-maids-of-february, purification-flower). A native of Europe, also containing narcissine.

Hyacinthus orientalis, H. nonscriptus (also called Agraphis nutans or Scilla nonscripta), and other related liliaceous bulbs contain a similar acrid juice which causes gastero-enteritis. The toxin is concentrated in the bulbs.

Fritillaria meleagris (snakes-head, fritillary, drooping-tulip, guinea-hen, guinea-hen-flower, chequered-daffodil, chequered-lily). A native of Europe. It contains the toxic principle imperialine, also contained in the popular garden plant F. imperialis (crown-imperial) from Persia and the Himalaya mountain region.

Clematis vitalba (travellers-joy, bindwith, biting clematis, hedge-vine, ladys-bower, maidens-honesty, old-man, old-mans-beard, smoke-wood, virginsbower). A native of Europe, containing the toxic principle clematine.

Clematis rubro-violacea, C. florida, C. virginiana, C. pitcheri, C. fremonti, C. integrifolia, C. lanuginosa, C. orientalis, C. recta, and other species of this genus, including the segregated genera Atragene and Viorna, natives of Europe, Asia, and North America. Many contain clematine; some have hydrocyanic acid; some containsaponin. The juice causes blisters and ulcers, violent inflammation of the skin, watering and inflammation of the eyes.

Anemone nemorosa (wood anemony, wood windflower). A native of Europe, containing the toxic anemonin and oil of anemone. All parts of the plant are extremely acrid, producing irritation and vesication on contact

with the skin.

Anemone apennina, *A. quinquefolia*, *A. coronaria*, *A. hortensis*, *Pulsatilla* spp., and related plants all have similar properties.

Ranunculus flammula (small spearwort). A native of Europe, containing a toxic acrid juice which causes a blistering of the mouth and skin. It is used by beggars to make sores and excite compassion toward themselves

Ranunculus auricomus, *R. ficaria*, *R. sceleratus*, *R. acris*, *R. bulbosus*, *R. asiaticus*, and most other members of this widespread temperate zone genus contain the same acrid juice, often along with anemonin. The poison is usually dissipated on drying. The juice acts as an acrid narcotic in warm-blooded animals, producing, in small doses, stupor and slow respiration; in large doses, paralysis of the extremities, convolsions, and death resembling that from apoplexy, accompanied by slavering, choking, and vomiting.

Paeonia officinalis (garden geony, piney). Native to Europe and western Asia; widely cultivated for ornament in all temperate regions. It contains an acrid juice, as does also *Aquilegia vulgaris* (columbine).

Bryonia dioica (red-berried bryony, common white bryony, white wild-vine, wild-hop, devils-turnip, grapewort, mandrake, murrain-berries, tetter-berry, isle-of-wight-vine). A native of Europe, containing the toxic principle bryonin, a drastic purgative, found also in the root of *B. alba*. The alkaloid bryonicine is also found in these plants. F

Cucumis colocynthis (bitter-apple, colocynth). A native of central Europe and the Orient, containing the toxic principle colocynthin, a drastic purgative. The outer surfaces of waterbags are smeared with this substance by peoples along the Nile in order to prevent camels from chewing the bags.

Ligustrum vulgare (common privet, prim, prim-plant). A native to Europe, widely cultivated as a hedge in temperate regions. The toxic principles are ligustrin, ligustron, and syringin. Syringopicrin is also reported from this plant and from the related *L. obtusifolium* (also called *L. ibota*; ibota privet) and *L. robustum* and the Chinese *L. sinense*. The poison is contained chiefly in the leaves and fruit, and children have become very ill from eating these.

Asarum europaeum (asarabacca, cahæret, hazelwort, wild-nard). A native of Europe, containing the toxic principles oil of bay and asarin, with purgative and blistering properties. *A. canadense* (wild-ginger, Canada wild-ginger) of eastern North America and *Pimenta acris* of India also contain these substances.

Saponaria officinalis (common soapwort, soapwort-gentian, hedge-pink, bouncing-bet, crow-soap, fullers-herb, london-pride, bruisewort, boston pink, chimney-pink, old-maids-pink, sheepweed, soaproot, worlds-wonder, sweet-betty, wild-sweetwilliam, lady-by-the-gate, woods-phlox, mock-gilliflower). A native of Europe, now naturalized throughout North America and other temperate regions. Its toxic principle is saporubin. Causes a decided allergy reaction and sinusitis in some people. Used by woodsmen as a substitute for soap.

Sapindus emarginatus and *S. saponaria* also contain saporubin.

Vaccaria vulgaris (also called *V. vaccaria* or *Saponaria vaccaria*; cow-herb) contains saponin, a neutral sharp amorphous substance having a burning taste and producing a violent sensation. It is native to Europe.

Agrostemma githago (also called *Lychnis githago*; corn-cockle, corn-rose, corn-campion, corn-pink, mullen-pink, old-maids-pink, crown-of-the-field, bastard-nigella, wild-savager). A native of Europe and northern Asia, containing the toxic principles smilacin, githagin, and saponin. This poison is a cerebro-spinal irritant, found throughout the plant, but mostly in the seeds. The plant grows abundantly in grain ("corn" of Europeans) fields and its seed is therefore often mixed with grain. Flour made of it is poisonous, with fatal results if the baking is not sufficient to decompose the poison. The effect may be acute, or, if a small quantity of the meal is eaten regularly, may be chronic. The gen-

eral symptoms of acute poisoning are intense irritation of the whole digestive tract, vomiting, headache, nausea, diarrhoea, hot skin, difficult locomotion, depressed breathing; coma is sometimes present and may be followed by death. F

Dianthus plumarius, *D. chinensis*, *D. caryophyllus*, *Anagallis arvensis*, *Aesculus hippocastanum*, *Quillaja saponaria*, *Gypsophila struthium*, and related plants also contain smilacin. The saponins which occur in about 50 different plant families act poisonously by dissolving the blood corpuscles.

Anacyclus pyrethrum (pellitory, alexanders-foot, bertram, lungwort). A native of the Levant, containing the toxic principles inulin and pyrethrim. The latter is almost identical with piperovatin.

Arnica montana (medicinal leopardsbane, mountain-tobacco, mountain-alkanet). A native of middle and central Europe. It contains arnicin, which may produce a form of dermatitis.

Doronicum pardalianches, of Europe and Asia, also contains arnicin.

Impatiens nolitangere (touch-me-not, common yellow balsam). A native of Europe, containing an acrid juice. The related *I. biflora*, of the U.S., is said to be emetic and poisonous to stock.

Erysimum cheiranthoides (treacle wormseed, treacle mustard). A native of Europe. It is an irritant and anthelmintic, containing the toxic fumarine.

Cynoglossum officinale (hounds-tongue, common dogs-tongue, gipsy-flower, dogs-tongue, rose-noble, canadian-bur, dog-bur, sheep-lice, tory-weed, wood-mat). A native of Europe, widely naturalized in North America and elsewhere. Its toxic principles are oil of houndstongue, consolidine, and cynoglossine. The last-mentioned resembles curare in its action and is a powerful alkaloid.

Symphoricarpos racemosus (common snowberry, St. Peterswort, snowberry, waxberry, snowdrop-berry, eggplant). A native of North America; widely cultivated in Europe and elsewhere in temperate regions for ornament. Its toxic principle is loturidine. *S. montanus*, *S. occidentalis*, *S. microphyllus*, and *S. vulgaris* also contain the same principle.

Tamus communis (black bryony, isle-of-wight-vine, ladies-seal, mandrake, murrain-berries, oxberry). A native of Europe, Persia, and northern Africa, containing an acrid juice with irritant and diuretic properties.

Euonymus europaeus (also called *Evonymus europaea*; common spindletree, European spindletree, skewer-wood, dogwood, catwood, pigwood, prickwood, louseberry-tree, ananbeam). A native of Europe and Asia Minor, containing the toxic principle euonymin, which is emetic and purgative. F

Euonymus atropurpureus (strawberry-bush, burningbush, wahoo, indian-arrow, strawberry-tree, bitter-ash, arrow-wood, spindletree), from North America, and *E. latifolius*, from Europe and Asia Minor, also contain the same substance.

Rhamnus catharticus (common buckthorn, french-berries, rainberry, rhineberry, harts-thorn, rhinethorn, waythorn, purgative buckthorn). Native of Europe and northern Asia; cultivated for hedges elsewhere; naturalized in parts of eastern North America. The toxic principle it contains is frangulin. The sap has strong purgative properties and is a local irritant. The unripe fruit was formerly used for staining maps and the ripe fruit furnishes the sap-green of painters. Pammel says the toxic principle in this species is rhamnetin, the rhamnin of earlier authors, and that frangulin comes only from the next.

Rhamnus frangula (alder buckthorn, black-dogwood, black-alder, berry-alder, arrow-wood, persian-berry). A native of Europe, naturalized in eastern North America. Its toxic principle is frangulin. Charcoal from the wood of this species is used for making gunpowder. It is native also to Asia and northern Africa.

Rhamnus purshiana (cascara sagrada). A native of western North America and the source of an excellent laxative. The toxic principle contained is purshianin.

Glaucium luteum (also called *G. flavum*, *G. glaucium*, or *Chelidonium glaucium*; yellow horned-poppy, sea-poppy, bruisewort, squatmore). A native of Europe and the Mediterranean region, but widely distributed now as a maritime weed. Its toxic principles are glaucine and chelerythrine, whose action is irritant. *G. corniculatum* is a purgative.

Chelidonium majus (celandine, cockfoot, tetterwort, greater celandine). A native of Europe and Asia; now widespread as a weed in North America. Its toxic principles are chelidonine and chelerythrine, the latter said to be identical with sanguinarin and found chiefly in the roots. The poison produces congestion of the lungs and liver, is an excessive irritant, and has a narcotic action on the nervous system, in its action resembling gamboge. The juice often irritates the skin. *C. grandiflorum* contains the same principles.

Bocconia, *Sanguinaria*, and *Adlumia*, related to the celandines, contain homochelidonin, which, in turn, contains three basic poisonous substances.

Sedum acre (common stonecrop, biting stonecrop, country-pepper, creeping-jack, runaway-jack, golden-moss, gold-dust, wall-moss, wallpepper, jack-of-the-buttery, mossy stonecrop, birds-bread, creeping-charlie, pricket, little-houseleek, gold-chain, tangletail, rockplant, pepper-crop, mountain-moss, ginger, poor-mans-pepper, prick-madam, treasure-of-love, love-entangled). This is a native of Europe and northern Asia; widely cultivated in all temperate regions and now naturalized in parts of North America. It contains an acrid juice producing inflammation and vesication when applied to the skin, often used in corns and warts to dissolve them. *S. album* (white stonecrop, wormgrass) and *Rhodiola rosea* (also called *Sedum roseum* or *S. rhodiola*; roseroot, rosewort, snowden-rose) also contain a similar or the same acrid juice.

Dionaea muscipula (flycatcher, venus-flytrap), *Drosera* (sundews, dewplants), *Pinguicula* (butterworts), *Nepenthes* (East Indian pitcherplants), and *Sarracenia* (pitcherplants, trumpets) all contain hydrocyanic acid and are poisonous to sheep and other grazing animals. They are insectivorous plants, many of them very rare in the wild state, but all widely cultivated in greenhouses, classrooms, and choice collections.

Crocus sativus (saffron crocus, common saffronplant). A native of Asia Minor and the Levant, containing the toxic principle crocin. It is the source of commercial saffron, taken from its style and stigmas. F

Crocus luteus and other species of this genus contain the same toxic substance.

Iris pseudacorus (yellow iris, yellow flag, fleur-de-luce, jacobs-sword, water flag). A native of Europe, Asia, and the Orient; widely cultivated for ornament and naturalized in parts of North America. The toxic principle contained is irisin or iridin, an acrid resinous substance acting powerfully upon the gastero-intestinal tract, liver, and pancreas, causing a burning sensation and congestion. It has emetic-cathartic properties which in the fresh state are very violent, but are retained to some degree even when dried and preserved. Growing along with and so closely resembling sweet-flad in foliage, its roots are often dug in place of those of sweet-flag, with serious results.

Iris foetidissima, *I. florentina*, *I. variegata*, *I. amoena*, *I. reticulata*, *I. tuberosa*, *I. versicolor*, and other species of this genus also contain iridin. *I. florentina* contains the glucoside irigenin, a derivative of iridin

Homeria collina, of South Africa, naturalized in Australia, is poisonous to cattle browsing on it.

Viola canina, *V. odorata*, *V. palmata*, *V. sylvatica*, *V. tricolor*, and other violets and pansies are said also to contain iridin, although Pammel calls the substance here violin. The seeds contain myrosin and a glucoside. The underground parts of most violets are emetic and cathartic and in large quantities may easily produce serious results in a child.

Polygala senega (seneca snakeroot, mountain-flax, rattlesnake snakeroot, senega-root). A native of eastern North America. Its toxic principle is polygalin, or, according to Pammel, polygalic acid, which breaks up into sapogenin and senegin. It also contains quillagic acid, sapotoxin, and two saponins. The poisonous part of the plant is the root. *P. amara* also contains polygalin, and *P. venenosa* contains saponin.

Ailanthus altissima (also called *A. glandulosa*; tree-of-heaven, tree-that-grows-in-Brooklyn, chinese-sumac). An Asiatic plant now widely naturalized in North America, growing profusely in cities. Its bark is poisonous. The pistillate trees during their flowering produce dermatitis on handling, or, according to many reports, mere proximity. The roots and leaves entering wells have been known to poison the water. The symptoms of poisoning by this plant are jaundice, a dingy aspect of face and eyes, countenance fixed and anxious, pulse frequent and soft, yellowish fur on tongue except at the tip and along the edges, tenderness over the liver, and, most important, a persistent pain over the stomach with paroxysmal vomiting, pain in the back, difficult urination, and obstinate constipation. The symptoms are those of chronic gastritis.

Rheum palmatum (turkey rhubarb, medicinal rhubarb, palmate-leaved rhubarb, shara-moto, djuntsa). A native of Mongolia; cultivated in Europe. Its toxic principles are rheonilic acid and chrysarobin. *R. compactum*, *R. undulatum*, *R. australe*, and other species are known to contain the same principles. At least one death has been reported from the cultivated rhubarb or pie-plant, *R. rhaponticum*. This entire group of plants is native to Mongolia, Thibet, Siberia, and the Himalaya region. F

Plumbago capensis (cape leadwort). A native of South Africa; widely cultivated for ornament outdoors in tropical regions and in greenhouses or tubs in temperate regions. It contains plumbagin and oil of plumbago. This and other species, like *P. europaea*, *P. coccinea*, *P. larpentae*, *P. rosea*, *P. scandens*, *P. toxicaria*, and *P. zeylanica* are variously emetic, narcotic, acrid, purgative, abortive, or irritant.

Dipteryx odorata (tonquin-bean, tonga-bean, tonka-bean). A native of the Guianas. Its toxic principle is coumarin used in snuff and to scent cigars, most easily detected after the plant wilts or is dead. The same substance is widely distributed in the plant kingdom, as, for instance, in such unrelated plants as *Angraecum fragrans*, *Anthoxanthum odoratum*, *Asperula odorata*, *Melilotus*, *Eupatorium*, *Myroxylon*, *Trilisa*, *Vitis sessilifolia*, *Prunus mahaleb*, and various palms, orchids, madder, and rue.

Toxicodendron vernix (also called *T. pinnatum*, *Rhus vernix*, or *R. venenata*; poison sumac, swamp sumac, poison-elder, poison-ash, poisontree, swamp-dogwood, poison-dogwood, poisonwood, poison sumach, swamp sumach, dogwood). A native of eastern North America, containing the toxic principle toxicodendrol. The tree lives in swampy places; its foliage is a beautiful red in the autumn. The fruit of all poisonous sumacs is white and more or less drooping. W

Toxicodendron radicans (also called *T. vulgare*, *Rhus radicans*, or *R. microcarpa*; poison-ivy, climbing-ivy, three-leaved ivy, poison-oak, climeth, trailing sumac, climing sumac, mercury, ivory, black mercury-vine, markry, markweed, picry). This is native throughout North America, Mexico, Bermuda, and the Bahamas. This and the related species *T. pubescens* (also called *Rhus toxicodendron* or *R. quercifolia*), the true poison-oak of the southern states, cause hundreds upon hundreds of cases of poisoning every year. Usually the poisoning is merely in the form of dermatitis venenata, but sometimes the poisoning becomes systemic. Several cases of death of children from this poisoning have been reported. There is a popular belief that within a year after the first attack there will be a repetition of the original manifestations upon the skin and that these may be repeated for several seasons. Most workers assert that animals are immune, but cases of dogs' eyes swelling shut as a result of wandering through these plants are recorded, but no eruptions were noted. Remedies include washing with a weaker grade of

50 to 75 percent alcohol saturated with sugar of lead. Soap, water, and the scrubbing-brush are, however, still the most efficacious preventives. W F

Rhus arborea, R. caustica, R. diversiloba, R. coriaria, R. rydbergii, R. floridana, R. littoralis, R. vernicifera, R. succedanea, R. sylvestris, R. wallichii, R. griffithii, R. striata, R. perniciosa, R. chinensis, R. javanica, and R. lucida are all poisonous in the same way. In fact, all genera of the Anacardiaceae should be looked upon with suspicion and avoided. Poisoning has been recorded from the genera Buchanania, Comocladia, Corynocarpus, Gluta, Holigarna, Lithraea, Mangifera, Oncocarpus, Pistacia, Pseudosmodingium, Cotinus, Metopium, Sclerocarya, Semecarpus, Spondias, etc.

Anacardium occidentale (cashew, maranon). The nut of this popularly cultivated tree is poisonous unless roasted until all the oil boils out. Care must be taken not to touch the oil in the nut with the bare hands as this will irritate the skin and cause swelling.

Urera baccifera (nettle-tree, ortiga, jano, chichicate, chichicaste). This shrub is often planted for hedges. Its stinging hairs produce pain that may last 24 hours or longer.

Cecropia spp. (trumpet-trees, guarumo, yagrumo). The branches in this group of trees are hollow and are inhabited by swarms of small ants that swarm out and bite painfully as soon as a leaf or branch is touched, accompanied by the injection of formic acid in the wound.

Metopium toxiferum (black poisonwood, poisonwood, burnwood, chechém, guao de costa). The sap causes blisters and prolonged inflammation of the skin. The smoke from the burning wood is as dangerous as the actual sap.

Hura crepitans (sandbox, tronador). The seeds of this commonly planted tropical tree are violently cathartic and may cause death. The milky sap is also poisonous and may cause serious inflammation. F

Mucuna pruriens (pica-pica, cowitch). An abundant plant in tropical thickets. Its stiff hairs are very irritant, and are especially dangerous about the eyes.

Dieffenbachia spp. (dumb-cane). The milky sap from the leaves and stem of these plants causes severe blistering and inflammation of the skin. The plants are also called otó de lagarto, rábano, and cimarrón.

Euphorbia cotinifolia (poison spurge, yerba mala, barrabás, yerba lechera). The milky sap of this tropical plant produces blisters and intense irritation of the skin.

Rhus striata (poison sumac, amché, palo de compadre, hinchador). The sap of this tropical tree causes blistering and swelling of the skin that may persist for weeks.

Comocladia spp. (guao, maíz, pelado, chinil, solimán, hinchahuevos). The sap of these tropical plants causes blistering and prolonged inflammation of the skin.

Cameraria latifolia (white poisonwood). This is said to be one of the most poisonous of all tropical American plants. Its sap causes blistering and severe skin inflammation. It is also called chechém de caballo, maboa, and laitier.

Croton ciliato-glandulosus (ciega-vista). A native of Mexico and Central America. The entire plant is covered with a sticky substance which if it comes in contact with the eyes may cause serious inflammation. Cattle are said to have been blinded by grazing among these bushes.

Laportea spp. (nettle-trees, ságai, sági, langáton, lingáton, enúling, lípa, lípai, lúpa, daun-gátee, sála, sosóro-bátja, kemáduh, kemáduh-kébo, sóro-bilalágo, sosóro-bobúdo, látang, keláting, púlus, saláto, lelése, élat, karktáo, káhtat, káhtl, lilíes). The leaf-margins, veins, petioles, and flower- and fruit-bearing parts are usually covered with stiff, very sharp, stinging hairs containing formic acid. These hairs are often inconspicuous. On light contact with the skin one imagines that one has touched a hot iron. If one grasps the leaf firmly there

is usually no sensation because the hairs are broken off.

Mucuna pruriens, *M. biplicata*, *M. cyanosperma* (cowhage, gónseng, kekáragátel, keráwe, kárung, raraweje, kówas, ípe, líkai, nípai, lúpoi, alilípai, danípai, dúglo, bukítkit). Parts of the flowers and fruit-pods are covered with stiff stinging hairs. It is particularly dangerous to get these near your eyes. The plants are common in the tropics.

Semecarpus spp. (rángas, réngasputeh, káju-sáju, léwer, lánat, rénat laulási, íngas, télik, égas, anágas, hanágas, líbas, lígas, lángas, párau, pánau, tóhngot, tóngot, tschóngot). Members of this tropical group cause a skin inflammation and dermatitis like poison-ivy, especially from the juice, if the tree is cut down.

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A partial list of plants setting up dermatitis venenata [this occurs in certain persons only and usually at certain seasons only. It is said that 1 person out of every 200 is susceptible, more especially women after 40 years of age]:

Abies
Aconitum
Ailanthus altissima
Amyris balsamifera
Anacardium occidentale
Andira araroba
Anthoxanthum odoratum
Antiaris toxicaria
Asperula
Atropa belladonna
Angelica archangelica
Bryonia dioica
Cerbera tanghin
Chelidonium
Cinchona
Clematis
Codiaeum
Coffea
Convallaria
Copaifera officinalis
Croton
Dictamnus
Doronicum
Ecballium
Eucalyptus
Euphorbia
Ficus carica
Filipendula
Ginkgo biloba
Gonioma kamassi
Grossularia
Helleborus viridis
Hedera helix
Hippomane manchinella
Humulus
Hyacinthus
Juniperus sabina
Laportea
Larix
Lithraea
Lycopersicon
Melilotus
Metopium toxiferum
Mangifera indica
Mucuna pruriens
Myrtus
Narcissus jonquilla
Narcissus pseudonarcissus
Nerium oleander
Origanum majorana
Parthenocissus quinquefolia
Papaver
Pastinaca urens
Pinus
Piper cubeba
Populus
Primula
Ranunculus
Rhus
Ruta graveolens
Sabina
Salix
Santalum
Sassafras
Semecarpus
Solanum
Strophanthus
Stachys
Tectona grandis
Thuja
Toxicodendron
Urtica
Valeriana officinalis
Bourbon teaplant
Cape poison-bulb
East Indian headache-tree
Indian chrysanthemum
Pepper-cress
Rhodes-wood
Satin-wood

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Additional poisonous plants of the tropics

Derris spp. (tuba, tugli, tubli, kaju tuba, toba, mombul, menengop, yup, duup, duva, nethon). Contains a poison used to stupefy fish. The poison is most concentrated in the roots, but exists also throughout the plant.

Barringtonia asiatica (putat laut, bitung, butun, hutun, koben, modgin, puutin, kun, futu, hutu, puting, utu, vutu, vup). Also employed as a fish-poison. The poison is strongest here in the seeds.

Tephrosia purpurea (avása, hóra, hóla, auhóla, kohúhu). The most used of all fish-poisons in Polynesia and Micronesia. The whole plant is pounded or crushed and thrown into the stream or lake.

Sapium spp. (ñipe, yos, chilamate, gum-tree, milk-wood, lechecillo, hinchanuevos, piniche, olive). The milky sap is said to be very poisonous, being used to poison arrows.

Karwinskia calderonii (huilihuiste, tuilldora, cacachila). Native from Texas to western Nicaragua. The seeds are highly poisonous, but the juice and fleshy

parts of the fruit should not be eaten either.

Coriaria thymifolia (moco tinto, moco de chompipe). Native of Guatemala and rarely Costa Rica. The attractive juicy red-purple berries are dangerously poisonous.

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A list of books and booklets especially useful

1. A manual of poisonous plants, by L. H. Pammel, 977 pp. 1910-1911.

2. Poisonous plants of the United States, by W. C. Muenscher, 266 pp. 1939.

3. Textbook of pharmacognosy, by H. W. Youngken, edition 6, 1063 pp. 1943.

4. Poisonous plants of all countries, by A. Bernhard-Smith, edition 2, 112 pp. 1923.

5. Edible and poisonous plants of the Caribbean region, by B. E. Dahlgren and P. C. Standley. NAVMED 127, 102 pp. 1944.

6. Emergency food plants and poisonous plants of the islands of the Pacific, by E. D. Merrill. War Dept. Technical Manual TM 10-420, 149 pp. 1943.

7. Edible, poisonous, and medicinal fruits of Central America, by A. B. Godshall, 47 pp. 1942.

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